Journal of the Society of Arts.

FRIDAY, JANUARY 25, 1867.

Announcements by the Council.

ORDINARY MEETINGS.

Wednesday Evenings at Eight o'clock :—

JANUARY 30.—On this evening the Report from the Judges on the Art-Workmanship Competition will be read, and the competitors and their friends will be invited to be present. Sir THOMAS PHILLIPS, Q.C., Chairman of the Council, will preside.

FEBRUARY 6.—The following subject for discussion will be introduced by Mr. HENRY COLE, C.B. :—"On the existing legal regulations in reference to the Cab Fares in the Metropolis, and their effect in rendering the Vehicles inferior to those provided in other European Capitals and the large Municipal Towns of this Country."

CANTOR LECTURES.

A course of Six Lectures "On Pottery and Porcelain," illustrated by specimens of various manufactures, and by photographs and diagrams, is now being delivered by William Chaffers, Esq.

LECTURE II.—MONDAY, JANUARY 28.

MAIOLICA.—Italy, Spain, Persia, &c.

LECTURE III.—MONDAY, FEBRUARY 4.

FAYENCE.—France, Spain, Portugal, Russia, Sweden, Denmark, &c.

GRÈS OR STONE WARE of Germany and Flanders.

DELFT WARE, &c.

LECTURE IV.—MONDAY, FEBRUARY 11.

ORIENTAL PORCELAIN.—China, Japan.

LECTURE V.—MONDAY, FEBRUARY 18.

EUROPEAN PORCELAIN. — Italy, Germany, France, Holland, Belgium, Russia, Poland, &c.

LECTURE VI.—MONDAY, FEBRUARY 25.

ENGLISH POTTERY AND PORCELAIN.—Early History, continued to the beginning of the 19th century.

The lectures commence each evening at eight o'clock, and are open to members, each of whom has the privilege of introducing one friend to each lecture. Tickets for this purpose have been issued to each member.

ART-WORKMANSHIP PRIZES.

The works sent in competition for these Prizes are now placed in the Society's Great Room for the inspection of members and their friends.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

CANTOR LECTURES.

"ON POTTERY AND PORCELAIN." BY W. CHAFFERS, ESQ.

LECTURE I.—MONDAY, JANUARY 21.

The first lecture of the course on pottery and porcelain was delivered on Monday, the 21st, by Mr. W. Chaffers, who illustrated his remarks by the exhibition of a collection of very fine specimens of ancient pottery of the Egyptian, Greek, Etruscan, and Roman periods, which were attentively examined after the lecture by the members. Behind the chair were placed numerous diagrams of the forms of Greek vases, drawings of the potter's wheel, a Saxon grave, urns, &c. The lecturer commenced by speaking of the nature of clay, and the various changes it was subject to from its primitive state, through all the intermediate stages, until it culminated in the perfect vase, dwelling upon the desiccation and baking of the clay, the means adopted by potters in the formation of vessels, viz., the potter's wheel, modelling tools, moulds, &c., the skill exercised by the artists in decorating the ware, and the difficulties they had to contend with in painting upon the moist clay; the nature of the glazes employed by the ancients; the shrinkage while in the kiln, and many other curious facts in connexion therewith. Mr. Chaffers alluded to the extraordinary circumstance that notwithstanding the fragility of specimens of ceramic art, and their liability to injury, our museums throughout Europe abounded with perfect and uninjured examples not only of pottery, but of the still more fragile material, glass. For the preservation of these we are indebted to the simple piety of the ancients, who, according to their rites of burial, placed in the grave those objects which the deceased esteemed most during his lifetime. Thus we find by the side of the skeleton, in the simple tumulus of earth, in the cinerary urn, or in the stone sarcophagus, gold and silver personal ornaments, fictile vases, and other ceramic remains, glass vessels, weapons, &c.; and this is the source of our possession of such valuable testimonies to the habits and customs of the ancients, for, without exception, all the relics preserved to us have been discovered either in places of sepulture, or in the exhumation of long-buried cities, devastated by conquest, or overwhelmed by volcanic eruptions. The lecturer then noticed the description given by Herodotus of the city of Ecbatana, the capital of Media, surrounded by seven walls of as many different colours, which he inferred were of bricks, or tiles with enamelled surfaces, and compared it with a building of similar character, described by Sir H. Rawlinson as still existing at Birs Nimrud, in Chaldæa, which, from the custom of placing cylinders in the buildings, is ascertained to have been restored by King Nebuchadnezzar 605 B.C., who designates it "The seven spheres of Borsippa." This structure consisted of six stages, each about 20 feet high, of pyramidal form, dedicated to particular planets, and vitrified or glazed with the colour attributed to it by astrologers. Adverting to the glazed Babylonian bricks, Mr. Chaffers showed the early knowledge of the use of the stanniferous enamel glaze as a covering for earthenware. He alluded to the researches of Mr. W. Kennett Loftus in Chaldæa, who discovered piles upon piles of earthenware coffins covered with glaze in a cemetery at Warka, proofs of the successive generations by whom this method of burial was adopted from its foundation until the place was abandoned by the Parthians, a period probably of more than 2,000 years. The earthenware of Egypt next claimed his attention, which he described as a sort of siliceous frit, frequently covered with a greenish blue glaze; the deities and emblems discovered so abundantly in the catacombs and tombs were many of them steatite, carved into form, and placed in the kiln. The earthenware vessels were used to contain the

waters of the Nile, and for various household purposes. The favourite ornamentation on their vases was derived from the lotus, its buds and flowers, the borders and details being taken from the petals, stems, and divisions of the calix. The most flourishing period of Egyptian art is assigned to a very remote date, viz., 2,000 years before our era. The period of the Ptolemies is known by the marked influence of Greek artists. The frit gives place to a pottery, coarse and soft, sometimes painted on the plain surface and sometimes glazed. This was continued down to the second and third centuries of our era, when Egypt was under Roman domination. In speaking of the Greek fictile vases, Mr. Chaffers said they were found in large quantities in the sepulchres of Etruria during the last century, and hence they were erroneously called Etruscan, even after they were still more abundantly discovered in Magna Græcia, Sicily, Attica, &c. It is indisputable that these vases are the productions of Greek artists, and the style of painting, the designs as well as the inscriptions, are decidedly Greek. This portion of the lecture was illustrated by some remarkably fine Greek vases, kindly lent to the lecturer by Mr. Felix Slade, Mr. Henderson, Mr. Battam, and M. Rollin. For the purpose of classifying the Greek vases he divided them into five periods, assigning approximate dates of antiquity, as follows:—First archaic period, previous to the eighth century B.C.; second archaic period, from the eighth to the seventh B.C.; third archaic period, from the seventh to the sixth B.C.; fourth, the finest period, from the sixth to the fourth B.C.; fifth, the decadence, from the fourth to the second B.C. The peculiar characteristics of each period are as follows:—The first archaic period; of these, the earliest specimens of Greek fictile art, most are discovered at Athens, Corinth, Melos, Camirus in Rhodes, and Etruria. They are very rude, painted in reddish brown or black, on ash-coloured ground, with chevrons, concentric circles, stars, &c., and primitive representations of men and animals. The vases of the second archaic period are abundantly supplied from Camirus in Rhodes, as well as other parts of Greece. They show a great improvement in the drawing of the figures; they are usually of cream-coloured clay, painted with crimson and white, and red on black, the details being scratched with a point, the style of ornamentation being two or more rows of animals (real or imaginary), of birds, harpies, sphinxes, &c. In the third archaic period are found the most valuable Greek vases, of a more artistic character than those which precede it. The figures are painted in black, on a red ground, and the designs are confined to a square tablet between the two handles, the rest of the vase being painted a lustrous black. Mythological and heroic subjects are now introduced, and complicated groups of figures, chariots, and occasionally inscriptions. The fourth is the best period of Greek art. These vases may be especially distinguished by the designs being left red, the ground filled in with black, and the details of costume, features, and anatomical delineations produced by black lines. Sometimes are found black figures on red, and red figures on black, on the same vase. This may be considered a transition from the archaic to the more artistic style. The fine vases of Nola may also be attributed to this period. The fifth period may be called the decadence, and dates from the accession of Alexander the Great, B.C. 336 to B.C. 186, when it is presumed the fabrication of painted vases altogether ceased, shortly after the edict of the Roman Senate against the celebration of the Bacchanalian festivals in that year. As we approach the second century B.C. we find less freedom in the design, a certain mannerism in the drawing, as well as a greater profusion of ornament.

Various specimens of Etruscan pottery were exhibited to illustrate the lecturer's remarks, and the Roman section was copiously illustrated by selections from his own collection, displaying the most striking varieties. The red ware of Arretium was described, as well as the Samian ware, so frequently discovered on the sites of Roman cities, ornamented in relief with mythological subjects and elegant scroll patterns; it was used by the Romans at the table for their meals. Mr. Chaffers also described other varieties of Roman ware found in Britain and Germany, and vessels of various forms, small drinking cups, inscribed with short convivial sentences, as "Imple," "Reple," "Bibe," "Vivas," "Da vinum;" mortaria, lamps, clay statuettes, &c., specimens of which were upon the table. In conclusion he spoke of the Saxon period, and described the contents of some of the Saxon or Frankish graves, which are dispersed over Northern Gaul, and the earthenware vessels so commonly found among them.

Seventh Ordinary Meeting.

Wednesday, January 23rd, 1867; Charles Vignoles, Esq., F.R.S., in the chair.

The following candidates were proposed for election as members of the Society:—

Brereton, F. S., 5, Cannon-row, Parliament-street, S.W.
Briggs, Henry R., George-yard Wharf, 36, Upper Thames-street, E.C.
Brinjes, J. F., 25, Fieldgate-street, E.
Cawston, Samuel W., Balham-hill, S.
Grisbrook, W., 154, York-road, Lambeth, S.
Stanger, C., Harley-villa, Grove-street-road, South Hackney, N.E., and 8a, Worship-street, E.C.

The following candidates were balloted for, and duly elected members of the Society:—

Bevan, Phillips, Albert-terrace, Windsor.
Davis, Sir John Francis, Bart., K.C.B., Club Chambers, Regent-st., S.W., and Hollywood, Henbury, Bristol.
Leeke, Admiral Sir Henry J., K.C.B., K.H., Theydon-park, Epping, Essex, and 5, Euston-place, Leamington.
Lewis, Evan, Aberdare.
Phillips, Thomas Henry, 51, Lime-street, E.C.
Pitter, Joseph, 2, Thanet-place, Strand, W.C.
Railton, George W., Alderley-edge, Manchester.
Roberts, Howland, Neilgherry-house, Hampstead, N.W.

The Paper read was—

THE IRON PERMANENT WAY IN USE ON GERMAN RAILWAYS.

By T. A. Rochussen, Esq., C.E.

The system of making railways, by levelling a layer of ballast, and forming an upper-structure of wooden sleepers, cast-iron chairs, topped with a wrought-iron rail, and held together by a wooden key, has, for a great number of years, appeared to German engineers to be unworthy an age in which the manufacture of good iron, and its composition into an efficient bearing system, are far better understood than thirty years ago, when the importance of railways as the principal arteries of our social and commercial intercourse was only just foreshadowed.

While locomotives and rolling stock had in their construction and performance progressively represented the advance of practical science, and embodied the genius of the designer, the care of the builder, and the aptitude of the worker in metal, to provide for all the requirements of traffic, it was felt in Germany, as well as elsewhere, that the time had arrived to apply the same intelligence to permanent way; and that it had become necessary, as much as possible, to reduce the variety of material, and to avoid that most liable to perish, like wooden sleepers, or cast-iron chairs, alike destructive to the wood below and the wrought iron above; and finally, to get rid of the crude contrivance of fixing rails by means of wooden keys. For this reason, the double-headed

rail, copied from English precedent, has enjoyed little favour in Germany, and where adopted, is gradually superseded by the more general practice of flat-bottomed rails, with or without bed plates on the sleepers.

The failure of Barlow's permanent way (perhaps a great deal owing to the use of inferior material) unfortunately discouraged railway directors from pursuing or sanctioning experiments in the right direction, and jeopardising dividends. While, therefore, different scientific papers published a number of schemes for the construction of iron permanent way, some patented, others given away *pro bono publico*, and all of them eagerly discussed at the meetings of practical engineers, the first step to realize a project was only made at the end of the year 1863, by putting in hand the different systems herewith illustrated, some of which came into actual use in the beginning of 1864, others in 1865.

The theory which guided these constructions may be summed up as follows:—

The nearest approach to perfection in a permanent way is to present to a moving load a sufficient, an unmoveable, continuous, and even resistance, as the only means of obviating the oscillation and thumping of fast trains.

Although the weight and height of the rails have been steadily increased, in order to spread the rigidity of the line over a large number of cross sleepers, there remains in practice an unavoidable deflection of rail between the points of support.

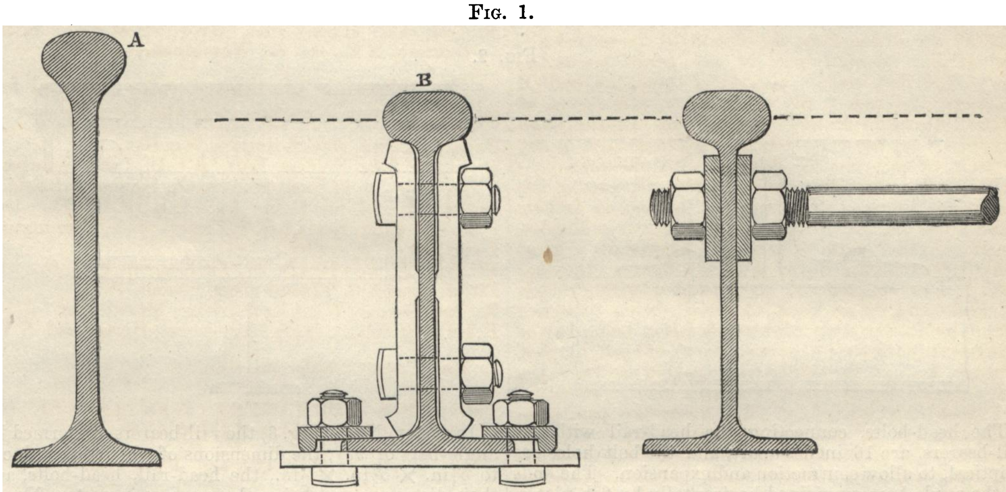
The bending down of the sleeper-end, taking place during the passage of the engine and the oscillation of the carriages or trucks, especially with old or soft wooden sleepers, sufficiently shows that the pressing load is not spread equally over the whole length of the sleeper, and is not evenly supported for the entire length of the wheel base, but that the chair, or point of support, receives a succession of blows, with the whole weight of the load resting on the axle.

If, therefore, we could devise a longitudinal way, possessing sufficient rigidity to transmit the pressure of the load over a large bearing surface, we should avoid the wave-like motion occasioned by the cross sleepers.

This resistance to pressure can be obtained in a simple ratio, by increasing the flat base resting on the ballast, or more economically, by increasing the height of the rail, since the power to support grows in the square ratio of the height.

The boldest and simplest plan of iron permanent way under consideration, was that advised by Mr. Hartwich, engineer of the Rhenish Railway, and laid down on the right bank of the Rhine, between Coblentz and Oberlahnstein, on a perfect level, and also between Mechernich and Enskirchen, the latter an incline of 1 in 70, and on a curve of 800 yards radius.

FIG. 1.



The ballast, always an object of especial solicitude with Prussian engineers, is of broken flint, and laid in a channel three feet broad at the top, shelving down to one foot, and eighteen inches deep. The rails shown in section A (see Fig. 1) eleven inches high, weighing 115 lbs. per yard, with a flat bottom of four inches, are placed immediately in contact with the ballast, and sleepers or bedplates are dispensed with. The space between the rails up to the middle of the head, and also the clear way outside the rails, are filled with fine gravel, tightly rammed in.

The rails are fished vertically and horizontally, as the rail of section B, nine inches high, which has since been ordered to the extent of fifteen miles, on the line between Kempen and Kaltenkirchen, and its adoption is likely to extend with the growth of Rhenish railways to the exclusion of the eleven-inch rails, which were found unnecessarily heavy and expensive. These rails are nine inches high with a flat bottom five inches wide, weighing 85lbs. per yard; the head, down to one inch of the web, is formed of steel, the web of fine grain, and the bottom of fibrous iron.

The vertical fish-plates, eighteen inches long, have two rows of fish-bolts for each rail-end, and to increase their stiffness have a longitudinal rib, resting against the web of the rail. The horizontal fish-plates, also eighteen inches long, are eight inches wide, and their connection with the rail is established by means of a cramp-plate, held between the nuts of the fish-bolt, and bearing upon the base of the rail. The use of this cramp is principally to allow a greater width of fish-plate, and to protect it against buckling up by the pressure of the rail. The rails are held to gauge by one-inch round bars, placed three feet apart, the ends of which are provided with a screw-thread, nut, and washer, at each side of the web, so as to allow an easy adjustment of widening or narrowing the rail distance to the proper gauge. Alternately, the cross, or gauge bars, are put either three inches from the top of the head or three inches from the bottom of the rail.

The whole weight of the system is 145 tons per mile per single line of way; the contract price all round being £13 15s. per ton; or, exclusive of ballast and laying down, £1,985 per mile.

The engineer reports:—"Since June, 1865, the double line from Coblenz to Oberlahnstein and the Mechernich line have been worked with tender-engines weighing 37½ tons; no alteration has taken place in the level of

the way, and the rails have nowhere worked into the ballast. The gauge has not in any instance been disturbed, the repairs of packing have been very trifling, and far less than on the line with cross-sleepers. The whole length forms a continuous, unmoveable railway; and although there is a little bending at the fish-joints, this inconvenience is imperceptible compared with the advantages of the whole system. The filling of the rail space with gravel, provided a more efficient security against sliding than the dogs and bolts in the wooden sleepers. The motion on the rail is perfectly free from oscillation and thumping; the noise of the passing train has a deep rolling sound, and although some passengers, who are acquainted with the peculiarity of the construction, pretend that the line is hard, the difference is not noticed by the majority of travellers. Whether the rigidity of these high rails will be more detrimental to themselves than the constant bending on cross-sleepers, time will have to show. If this disadvantage should manifest itself, it could be met by increasing the elasticity of the springs; on the other hand, the rigid surface offers a saving of traction power and wear of wheels, considering that with rails bending between sleepers every wheel practically runs on an inclined plane. It may be urged that, if once the rail heads should be worn out, the whole system will require renewal, but as an extensive experience with steel headed rails in Prussia, during 14 years, has shown that the life of a good rail, even under very onerous circumstances of traffic, is about 21 years, this objection falls to the ground, the more so since the rails of the present day, on wooden sleepers, have already reached the same weight per yard as our whole system without sleepers."

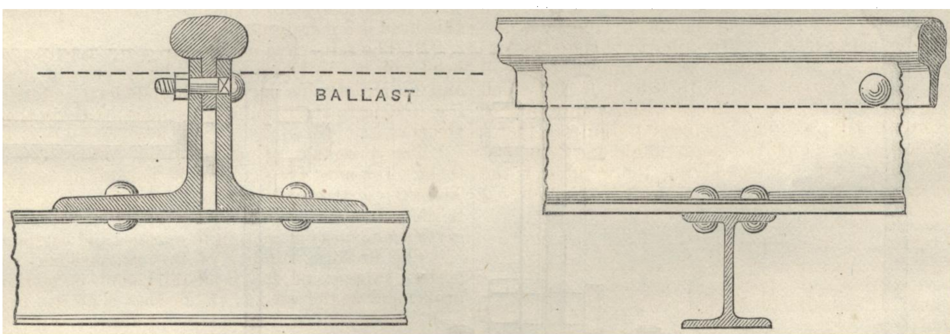
In the beginning of the year 1864 the Hoerder works, in Westphalia, supplied the Brunswick Railway with the two systems of iron permanent way represented by Figs. 2 and 3, each of about 1,100 yards in length, and some time afterwards with another variety of the same system, represented by Fig. 4.

The two first are lying side by side on the distance between Brunswick and Wolfenbuttel, that portion of the main line from the west to Berlin on which the wear of oak sleepers and the general repairs of the permanent way had been the heaviest of the whole distance between Cologne and Berlin.

The three systems embody the principle of supporting the head of the rail between the vertical arms of two angle bars, riveted together, and held to gauge by cross-bars, the dimensions and distance of which, as well as of the angle-bars themselves, being varied in order to ascertain the maximum limit of saving material which may be approached without jeopardising the efficiency of the construction.

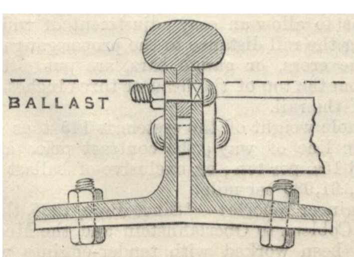
In the system shown in Fig. 2, the longitudinal rectangular angle-bearers measure 6in. × 6in. × $\frac{1}{2}$in., and are placed half an inch apart, to allow the web of the head rail to slip in. The gauge, or cross-bars of T iron, 4in. × 3in. × $\frac{3}{8}$in. are placed five feet apart, and are riveted below to both the horizontal arms of the angle-bars.

FIG. 2.



The head-bolts, connecting the head-rail with the rail-bearers, are 16 inches apart, and the bolt holes are elliptical, to allow contraction and expansion. The ends of the angle-bars are joined horizontally by fish-plates, 12in. × 12in. ×in. × $\frac{1}{2}$in., fixed with eight screw bolts, say two bolts to each end. The head-rail and rail-bearers break-joint—the ends of the former being thus supported by a continuous bearing of the latter. This system of construction gives 334 square inches of horizontal bearing surface per running foot, that is to say, 300 square inches from the horizontal arms of the angle, and 34 square inches from the cross-bar.

FIG. 3.

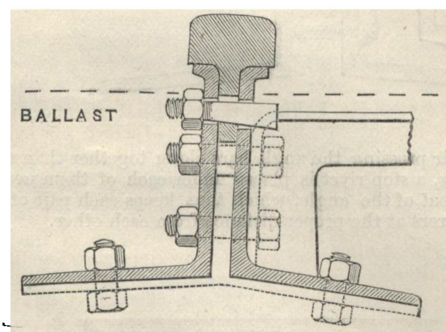


In system No. 3 (Fig. 3) the rail-bearers are formed by angle-bars of 93°, the dimensions of which are reduced to $5\frac{1}{4}$in. × $5\frac{1}{4}$in. × $\frac{1}{2}$in., the head-rail, head-bolts, and their distance apart being the same as in system No. 2; but the cross-bars, here placed only three feet apart, were made of flat bar 3in. × $\frac{1}{2}$in., ending in a T section, which is riveted through the two arms of the rail-bearers. In order to prevent the squeezing together of the latter, a half-inch fillet-plate is inserted between them. The fishing of joints is effected as in system No. 2, and the horizontal-bearing surface is 274 square inches per running foot of railway.

On the wear of the railway, the engineer, Mr. Scheffler, reports as follows:—"The two systems lie side by side in a straight line, half the distance being on well-drained large gravel, the other half in fine gravel mixed with clay, very impermeable to the percolation of water. Both lengths have been worked for more than two years, and are in excellent preservation, continuing to bear a heavy express, passenger, goods, and mineral traffic. The state of the rails has been uninterruptedly satisfactory, and they have not required the same labour of keeping up which was necessary for the other portion of the railway. This contrast was especially remarkable in winter during a prolonged low temperature. After the thaw in the spring of 1865 only in the system No. 3, in those portions of the line where the ballast is unusually bad and clayey, a few instances of sinking occurred,

but not to the same extent as on the line with cross wooden sleepers; however, on the larger portion of system No. 3, and on the whole of system No. 2, no packing or adjusting of any kind has been necessary. This favourable result is, perhaps, to be ascribed to the great height of the rail-bearers, which permit the bearing surface to lie deep in the ballast, and reduce the influence of frost on the base of the rail. The packing and lifting, when required, are an easy operation, and these constructions have shown no instability—a gratifying fact, since eminent engineering authorities, looking at the flat base of the rail-bearers, predicted a shifting sideways of the whole line. After two years' heavy traffic no displacement has been perceptible; all the component parts of the iron permanent way are in their original good condition; not a single rivet has worn loose, but the nuts of the head-bolts require now and then to be tightened with a spanner, as in those of the fish-plates of the ordinary construction. The iron, including the portion submerged in the ballast, has been oxidized to a trifling extent, and hitherto experience has not justified the preference of one system over the other. The motion on both systems is a little harder, but, at the same time, much more steady and smooth, than on the most carefully constructed permanent way with wooden sleepers. Hitherto it has been impossible to note any difference in the motion of the carriages during the various influences of extreme heat or cold, it is the same in winter as in summer. In the manufacture of the rail-bearers for systems Nos. 2 and 3, the Hoerder works found a difficulty in rolling the top of the vertical arm to a sufficiently clear edge, and this inconvenience necessitated their being planed. In order to obviate this expensive operation, the Hoerder works proposed to roll the top of the vertical arm with a bulb or rib, which allows a true edge to be produced without any further mechanical finishing. The Brunswick Railway thereupon resolved to adopt this bulb angle in their last system, No. 4 (Fig. 4.), embodying the weight of the smaller section No. 3, which in practice had proved

FIG. 4.



sufficiently strong, at the same time giving a conical form to the head bolt, in order, when tightening the nut, to press the head rail down on the rail-bearers. This head is made of cast steel. While keeping to the weight of the former section they increased the height of the vertical arm to $6\frac{1}{2}$ inches, the horizontal arm to $5\frac{1}{2}$ inches, the thickness of both being $\frac{3}{8}$ths of an inch full. Another deviation from systems Nos. 2 and 3 is the form of the cross-bars, which are of channel or C iron, 4 inches $\times$ $1\frac{3}{4}$ inches $\times$ $\frac{3}{8}$ths of an inch, placed five feet apart, as in system No. 2, and are fastened with bolts and nuts through the two vertical rail-bearers. The horizontal supporting surface of this system is 306 square inches per running foot of railway. It does not appear advisable to place the cross-bars at a greater distance from each other, since they not only serve to keep the line to gauge but also contribute in holding each pair of rail-bearers together to prevent their buckling and, at all events, the greater rigidity of the system compensates for the trifling, if perhaps superfluous, outlay. Experience will teach us the maximum distance of the cross-bars, and also whether a large number and their submersion in the ballast offer (as we have hitherto found) a sufficient resistance to the supposed tendency of the railway to move sideways, or whether it is advisable, for additional security, to adopt keel-fishes. The cost of the iron permanent way, exclusive of ballast and laying down, has been 36s. per yard, or, with laying down, £3,200 per mile, as against 25s. per yard or £2,250 per mile for the ordinary construction with wooden sleepers. The weight of the three systems is—No. 2, per yard, 354lbs.; No. 3, 295; No. 4, 300. The Hoerder works supplied the material for systems Nos. 2 and 3 at £13 5s. per ton, delivered at Brunswick; but for system No. 4 stipulated an advance of 5s. per ton, on account of the wider dimensions of the angle bars, which necessitated the use of better iron. The building up and laying of the permanent way, after the labourers got used to the work, progressed rapidly; the cost of laying down was 10d. per yard, as against 7d. per yard for the old system. The ballast under the iron way is of the same depth as that under the wooden sleepers, viz., 12 inches, and practice has shown this to be sufficient.

"The experience of two years has not yet furnished conclusive data exactly to fix the cost of keeping up the line, but we have found—

"1. That packing has been much less needed than with the ordinary cross-sleepers, and the expenses under this head are merely nominal.

"2. The rails have not required any repairs; neither head-rail nor rail-bearers have been renewed or altered; and it is remarkable that the rail-ends have suffered much less (owing to their uniform support) than on the cross-sleepers.

"The principle of longitudinal construction is, in theory, the most correct, and is borne out by practice. The even continuous bearing is of immense importance to the permanent way, as well as to the rolling stock, and gives a much easier motion to engines and carriages.

"The uniform rigidity of this rail system, and the perfect support of the head-rails, show a marked improvement in the wear of the heads. The use of rivets—in places where frequent renewals are not likely to occur, as in parts covered by the ballast, and therefore not much shaken—is not objectionable. The number of component parts is not large, their connexion is easily established, and practice has proved the construction to be strong. The rigidity of the iron permanent way, both vertically and horizontally, is much greater than that of the cross-sleepers. This is proved, not only by the analysis of form and dimensions of the section, but also by the steady motion of the rolling stock, and this advantage is conspicuous in express and heavy mineral trains."

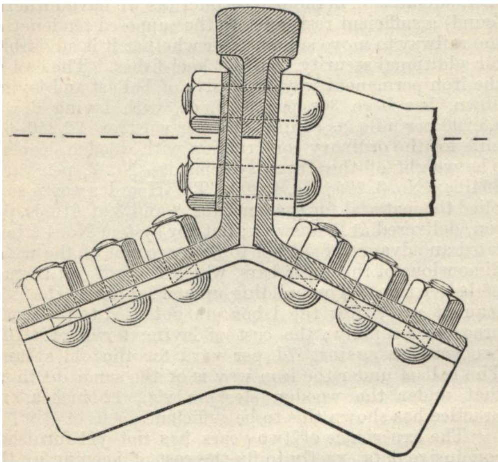
Thus far Mr. Scheffler. After the favourable experience obtained on the Brunswick line, the Hanoverian, Cologne-Minden, the Saxon and Wurtemberg State railways, have resolved to lay down experimental lengths of iron permanent way, constructed on analogous principles.

The Hanoverian system, illustrated by Fig. 5, was made by the Hoerder works, according to the specifications of the engineer of the line, but it does not appear to offer any advantage in theory, while its cost is much higher than that of the Brunswick system. The Hanoverian permanent way has the same cast-steel head as system No. 4; but the rail-bearers, $\frac{1}{2}$ inch thick, are formed of angle-bars of 115°, $5\frac{1}{2}$ inches high, and $6\frac{1}{2}$ inches base, giving a horizontal bearing of 12 inches wide, equal to 288 square inches per running foot of railway.

The rail-bearers are riveted together, with a fillet plate, as in system No. 3. The head-bolts, conical, as in system No. 4, placed 18 inches apart, have a collar

under the nut, which, pressing the rib of the angle, counteracts the supposed tendency of the head-rail to incline outwards.

Fig. 5.



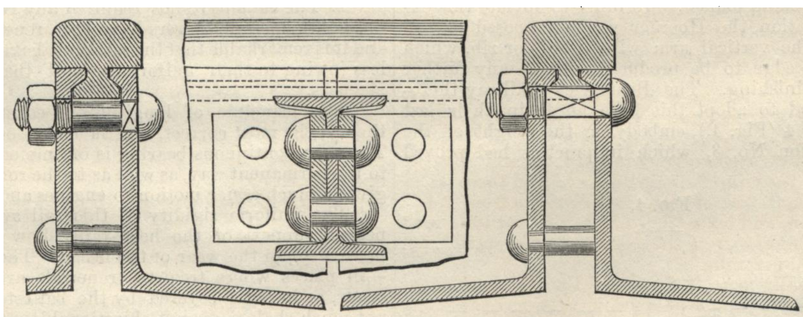
The bars, 3 feet apart, of 3 inches × $\frac{3}{4}$ inch flat bar, are, as in system No. 3, riveted with T angles to the angle-bearers. The keel fish-plates are formed of T iron, 5 inches × $2\frac{1}{2}$ inches × $\frac{1}{2}$ inch. About five miles of this iron permanent way were laid down in 1866, which give a very satisfactory result; they will, however, only be thoroughly reported on after next spring.

A variation of the iron permanent way of systems Nos. 3 and 4, is now being constructed at Hoerde for some German railways, on a plan patented in this country by the author, and the advantage of which was developed during the manufacture of the material for the Brunswick and Hanoverian way. (Models, full and half-size, were on the table.) When the metal used for the head-rail was changed from the use of iron to the use of cast-steel, it was no longer practicable to punch the bolt holes in the web, and every hole had, at considerable expense, to be bored and slotted out.

Besides, under all circumstances, particular care was required in correctly adjusting the holes in the web with those of the rail-bearers. These combined considerations made it desirable to devise a system establishing a direct and strong connexion of the head-rail and rail-bearers, without the head bolts passing through both, and led to the combination illustrated by Figs. 6 and 7.

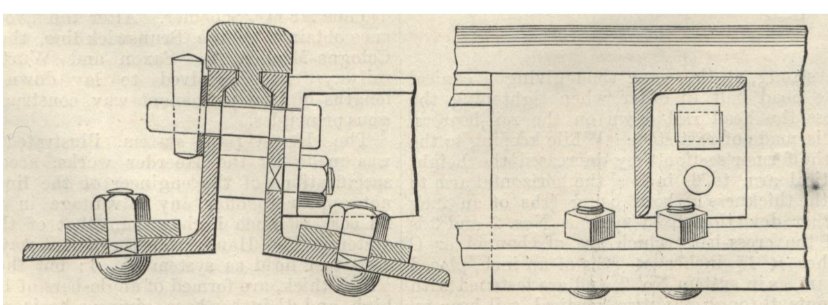
The bulb or rib of the vertical arm instead of being placed outside, as in the Brunswick permanent way, No. 4, is here turned inwards, and is rolled into a dwarfed T section, thus forming a groove into which the ribs or bulbs of the rail-bearer gripe; and the whole system is

Fig. 6.



tightened and firmly held together by the screw bolts, or wedge keys, passing through the rail-bearers under the head without touching the web at all. The head bolts are placed 20 inches apart; and in order to prevent their pressing the angle bars closer together than necessary, a stop rivet is placed under each of them near the throat of the angle, which thus keeps each pair of rail-bearers at the proper distance from each other.

Fig. 7.



In Fig. 7 a plan is suggested to effect economy of material by slightly reducing the height of the rail, and replacing expensive screw bolts with cheaper keys and wedges, all of which can be simply rolled as a bar and cut off to the requisite size.

The cross bars of these systems can, of course, be made

of any section of iron. Those now making are partly of double T iron, partly of angle iron, bolted to the inner arm of the construction. By these means the outer arm of the rail-bearer can at all times be removed for the purpose of shifting, reversing, or renewing the head rail, without disturbing the gauge of the railway. The cross bars are most conveniently fitted near the end of the rail-bearers, where they contribute to stiffen the fish-joint, and at the same time serve admirably as supports of the points, which move easily over the flat surface of the cross bar.

In order to prevent the sliding backwards and forwards of the head rail by the friction of the wheel, a square stop bolt is applied to the head, passing through a notch in the web at each end of the rail. A few holes are punched here and there in the horizontal arm of the rail-bearer to assist in draining the ballast.

It is scarcely necessary to urge anything in favour of the principle of longitudinal permanent way generally. In some countries the first cost may appear greater; but the ever-increasing expense of keeping up wooden sleepers, especially in hot climates; the interruption of and danger to traffic during repairs; and, on the other hand, the advantages offered by the iron way of decreased wear of rolling stock, as well as increased safety and comfort in travelling, are considerations of such importance as to render the abandonment of the present cross-sleeper construction merely a matter of time.

In the systems just described the life of the iron parts is practically unlimited. The only portion subject to gradual wear is the steel head, weighing about 34lbs. to the yard; and this economical application of the more expensive material justifies the engineer in using crucible cast steel of a high class, instead of the cheaper but less durable Bessemer steel, which, for good financial reasons, is the only steel which railways have hitherto allowed themselves to use.

The weight of the new system, as per dimensions shown in Fig. 6, is 223 tons per mile; the cost, inclusive of laying at 9d. per yard, about £3,100.

The weight of system No. 7 is 193 tons, and the cost about £2,700 per mile of single railway. But these prices are based upon the use of high-class Prussian iron, at £12 to £14 per ton, and bolts from £24 to £30 per ton; with the use of English iron the cost per mile should not exceed £2,200 per mile.

I would finally urge, in favour of the iron permanent way, the consideration that wood is getting scarcer and dearer every year, and may well be saved from decaying in the ballast in order to fulfil the nobler mission of meeting the numerous wants of our domestic and social habits and dwellings. And if railways in England and its colonies were generally to adopt the iron permanent way, an immense impulse would again be given to an industry now unfortunately languishing, but the prosperity of which forms the back-bone of the wealth and power of this country.

Weight and Cost of System No. 6 per Mile, calculated on the price of Prussian Iron.

(PER LENGTH OF 20 FEET.)

				£	s.	d.
2 head rails........	460 lbs.,	at 16s. 6d.	cwt.	3	7	9
4 rail bearers......	1,180	„ 12s. 0d.	„	6	5	7
3 cross bars	170	„ 13s. 6d.	„	1	0	9
4 fish plates	26	„ 12s. 0d.	„	0	3	0
62 bolts and nuts....	48	„ 30s. 0d.	„	0	12	9
22 stop bolts........	8	„ 24s. 0d.	„	0	1	9
	1,892 lbs.			£11	11	7

	£	s.	d.
= per mile, 223 tons	£3,056	18	0
Laying down, at 9d. per yard	66	0	0
Total..........	£3,122	18	0

Weight and Cost of System No. 7 per Mile, calculated on the price of Prussian Iron.

(PER LENGTH OF 20 FEET.)

				£	s.	d.
2 head rails........	460 lbs.,	at 16s. 6d.	cwt.	3	7	9
4 rail bearers......	1,050	„ 12s. 0d.	„	5	12	6
4 cross bars	44	„ 12s. 0d.	„	0	4	8
4 fish plates	26	„ 12s. 0d.	„	0	3	0
26 wedges and cotters	37	„ 18s. 0d.	„	0	5	11
18 stop bolts........	7	„ 24s. 0d.	„	0	1	6
16 bolts and nuts....	16	„ 30s. 0d.	„	0	4	0
	1,640 lbs.			£9	19	4

	£	s.	d.
= per mile, 193 tons	£2,631	4	0
Laying down, at 8d. per yard	57	0	0
Total..........	£2,688	4	0

DISCUSSION.

MR. ROBERT MALLET, F.R.S. (responding to the invitation of the chairman), said he had listened with great pleasure to the paper, some of the details of which he was before, to a certain extent, acquainted with, having himself seen the permanent way alluded to in Germany last year. He thought no doubt could be entertained, in the present day, that the epoch of timber sleepers was approaching its close, but the question arose what we were to substitute for them. There were two or three principles which were incontrovertible with regard to permanent way—one was that the nearer we approached to a lathe bed the nearer we were to perfection, but in a lathe bed we had a uniform load passing over it at a uniform speed, and a uniform support for the entire length; therefore, we could afford to make the bed of perfect stiffness, and could maintain it true. A railway was placed under different circumstances. It could only be supported at intervals. For, even if it was a continuous iron way, resting upon continuous ballast, it was in fact only supported at intervals. If the table of the rail itself were of such a weight, and possessed such inertia that the load in passing over it caused concussion at the immediate attachments of the rails, it mattered not if the material of the ballast were india-rubber, the result would be the destruction of the rolling-stock in proportion to the inertia of the table it ran upon. They might mitigate this by springs as regarded the carriages, but they could put no springs between the wheels and the axles. Wheels of 4 feet, or 4 feet 6 inches diameter, and often $2\frac{1}{2}$ inch tires, with axles often 7 inches, and seldom less than $4\frac{1}{2}$ inches diameter, were in themselves prodigious hammering masses, and at high speed there was practically a succession of hammering blows. Take any point in the circumference of a wheel: that point described a cycloid, and at each moment of its touching the rail the tangent of the cycloid was perpendicular to the rail, and thus the point descended with a direct hammering blow, the effects of which were in proportion to the weight of the wheel and the velocity with which the point of the periphery struck the rails. There was therefore a succession of blows, which they must mitigate as best they could. If they had an enormous inertia in the metallic parts of the rails, the result would be similar to that illustrated by Belzoni the traveller, who placed a heavy anvil on his chest, and allowed blacksmiths to strike it with hammers. This appeared to be a feat of marvellous strength, but so long as his ribs were strong enough to bear the weight of the anvil, the force of the blow was expended on the anvil itself, and the heavy permanent way just did the same thing. It therefore appeared to him that if they adopted iron sleepers they must arrange to make the bearing elastic in some way, but how that was to be effected with these deep rails and double angle irons appeared to him a matter of some difficulty. There could be no question that an enormous advantage was gained by the substitution of steel for

iron in the upper part of the rail. The London and North-Western Railway, which was considered as a pattern railway in respect of the large traffic and the regularity and rapidity with which it was carried, had substituted steel for wrought-iron rails, without reduction in the weight of metal. They were not attempting to economise in the outlay for the substituted rails, but the economy was looked for in the greater resistance to wear and tear. He believed the experience of Mr. Rochussen with steel rails for the light traffic of the German lines had been different to that in this country generally. He apprehended the life of a steel rail, instead of being 21 years, would, on some parts of the London and North-Western, scarcely be as many months. At the same time, there was no doubt the steel rail was the right thing. If they got a material which did not hammer down, or laminate, as the surface of soft wrought iron did, there was the greater reason why, with an enormously rigid material like steel, they should have beneath it an elastic support. He only ventured to assert that as a principle, because if he went into particulars it would lead him to talk of himself as a permanent-way inventor, and he would be sorry to do that. He confessed he did not see that that was effectually done by these angle-irons. It was very similar to what our ingenious fellow-countryman, Mr. Bridges Adams, had patented; the main difference was that he turned the angle-irons the other way. It seemed to him, in the arrangement adopted on the German railways, there was a certain liability to become uneven. The steel top, which bore the load, itself rested upon the narrow edges of these two angle-irons. In all these systems the question was what amount of surface had they in the angle-iron to support the steel table above; because though the steel top might be permanent, it was doubtful whether the angle-iron might not give way at the point of contact with the steel top. He confessed that the bearing surface in the case before them appeared to him exceedingly small, and he apprehended some difficulty in that direction. But no man, not even the chairman, who was himself one of our most successful designers of rails, could predict beforehand what would be the results of the working of any permanent way; nothing short of actual trial under rolling loads would decide whether a permanent way would answer or not. He was far from attempting to dogmatise with respect to these German lines. The system might be found to answer there better than he expected; and his general observation of those lines showed that for the most part they had hitherto worked well.

Mr. Rochussen wished to speak with the highest respect of Mr. Adams's system, and he regretted that it had not been adopted in this country to the extent which he considered its merits deserved. The difference between the two systems was, that Mr. Adams's was a suspended rail, held with two angle bars, in which the angle, instead of standing up, was hanging down. It would have been well to have had more experience of that system.

Mr. Varley remarked that a rigid permanent way appeared to be excellent to a certain extent, but that a due amount of elasticity in the bearings must be provided. It occurred to him that it would be well to ascertain positively the flexure of the rail, and then make it so convex as to keep it level by the weight. He had passed over the railway at Chat Moss, where the road was highly elastic, and it was the smoothest travelling he had ever experienced.

Mr. W. Botly said, mention having been made of the Bessemer cast-steel, some few years ago it was considered a great triumph of science that steel could be produced in about two hours, which operation formerly took, on an average, about a fortnight. It had been stated in the paper that the Bessemer steel was not so good as that which had been converted by the crucible process. He wished to know whether this was generally admitted. He apprehended that the welding of the harder material (steel) upon one of a more elastic nature (iron) furnished the conditions that were required for a permanent way. He begged to ask whether greater inconvenience, in respect of the wheels of the carriages not biting the rails under certain circumstances, was experienced with steel rails than with iron rails.

Mr. Rochussen said no one was more convinced than he was of the merits of the Bessemer invention. But on the other hand he believed Mr. Bessemer himself would be the last to advance that his process could produce a metal which in every way equalled the old crucible cast steel. It was a method of converting cast iron into malleable iron, and then into steel, which had all the convenience of being cheap, and of enabling them to deal with large masses of material. That system had been worked as successfully in Prussia as in this country, and he believed the manufacturers of Prussian Bessemer steel had no reason to be ashamed of their production. He admitted that the "biting" of the wheel on a steel rail was less than that on an iron rail, but they found less inconvenience from that in Prussia, inasmuch as the weight of the rolling stock upon the same wheel base was almost double that of the rolling stock used in England. First class carriages weighed from 10 to 11 tons. The luggage trucks were of the capacity of 10 tons each, and this remark would more or less meet the observation made by Mr. Mallet with reference to the supposed light traffic on the Prussian railways as compared with this country. These rails had been laid down on the German lines for the most part where the traffic was exceedingly heavy, and where it was necessary to provide something more durable than the old system afforded. The duration of steel rails, which he had advanced as being 21 years, was proved by the steel rails laid down at the Hamm station in Westphalia, which might be regarded as a counterpart of the Crewe station in this country—not that the traffic was so great, but it was the principal junction on the Continent for the mineral and coal traffic; and when a discussion on steel rails took place at the Institution of Civil Engineers, he produced some rails which had been taken from that junction, where they had been in use 12½ years, after having sustained a traffic of 50 millions of tons of goods. Those rails, which were of the Vignoles form, had then only one side of the head slightly abraded; they were not in any way worn, and were fit to work for another five years at least, having the other side of the head untouched. Those rails were only 56 lbs. to the yard, having been made at a time when engines weighing from 37 to 48 tons were not dreamt of, and when, if such engines had been in use, iron rails of 85 lbs. would have to be laid down. With regard to steel-headed as compared with solid steel rails, he would remark that it was the compound nature of the rail which formed the backbone of support to the load. As Mr. Mallet observed, they wanted elasticity, and how did they provide it in a steel rail? They could not weld the steel to iron upon that large scale; therefore the steel was made to rest directly on the material which had the greatest affinity for it, viz., puddled steel, and below that they placed the most elastic fibrous iron that could be found. If, from motives of economy, they did not use cast steel for the head, they employed puddled steel, and fine grain iron for the web, such as was known in this country as the Low Moor, and again fibrous iron at the bottom. But in speaking of this kind of permanent way, regard must be had to the support it received from the ballast which, in the Prussian system, formed a most important portion of the line, for the work ordinarily thrown upon the sleepers was, in a great measure, done by the ballast, and by that means the violent concussions described by Mr. Mallet were avoided, the ballast in reality taking a large portion of the work of the line.

Mr. Juland Danvers wished to ask one or two questions, being interested in the construction of railways and public works in India. It seemed to be

universally acknowledged by the preceding speakers that the use of wood for sleepers was condemned. He would be glad to know why that was the case? He saw in this country wooden sleepers almost universally adopted, and this was also the case on the Continent, except on some of the German lines. In America iron had rarely been introduced for sleepers, and yet it appeared that wood was now generally regarded by the profession as a failure. This was a very important question as regarded India, where timber was plentiful, but hitherto they had been unable to supply iron; all the iron was obtained from Europe, and this increased very much the cost of railways in India. Wood had certainly failed there as sleepers, and half the lines were constructed with the iron pot-sleepers. He was anxious to ascertain why, if good durable wood could be obtained, at a much cheaper cost than iron, it should not be made use of; and why, as a general rule, iron was so much preferred? He knew many instances in which iron had cracked, while wood often lasted a considerable time. A short time ago he was requested by the India Department of the Government to inquire into this question, and the conclusion which he reluctantly came to, after taking all the evidence he could collect, was, that unless a cheaper and more durable wood was obtained in India, it would be desirable to employ iron sleepers very generally in that country.

Mr. MALLET added, on the subject of wooden sleepers in America, that the abundance of that material put iron sleepers quite out of consideration. Wood was almost a drug, while iron was the most expensive material that could be employed in construction in that country. The railway system was begun there by using strips of wood with bar iron, little better than hoop iron, on the top; now they had iron rails, and by-and-bye they might get to iron sleepers. With respect to sleepers in India, hard wood was principally used for the purpose, and was said to be very durable, if protected from the attacks of the white ant; otherwise it was rapidly destroyed. In tropical climates, not of the arid nature of a large portion of India—such as Panama—wooden sleepers had disappeared in a remarkable manner very rapidly, though composed of very hard wood. Wood was an increasingly dear commodity in this country, and would not stand the traffic of our lines, unless oak were employed, which could not be obtained in sufficient quantity. He believed the chairman would confirm the statement that in Russia oak sleepers were used almost entirely.—[The CHAIRMAN said this was the case in Russia wherever it was possible.] With reference to what had fallen from Mr. Rochussen on the subject of the different qualities of steel for rails, he (Mr. Mallet) did not think it of much importance whether crucible steel or Bessemer steel were used. It was simply a popular error to suppose that Bessemer steel was worse for the purpose than the best cast steel made by cementation in a crucible. He had seen as good steel made by the Bessemer process as by that of cementation, but the commonest Bessemer steel could be made into good steel, possessing every necessary quality, by allowing the metal to remain in a melted state for some time in a reverberatory furnace. M. Sudré was the first to show that steel could be melted in a reverberatory furnace, and that if the mass of molten metal was covered by a coating of glass, of the quality of ordinary wine bottles, the steel was effectually protected thereby from the action of any sulphurous matter which might be contained in the fuel. Independently of that, however, a new process of steel manufacture had grown up since the introduction of the Bessemer process. It was found that very excellent steel might be made by melting down scrap iron in pots, which might be heated twenty at a time in the Siemens furnace; and, with the addition of spiegel-eisen to the fused mass, and by stirring it up well, it was converted into steel. That process was now in operation by Mr. Siemens, and the result of his working was, that he could make a ton of steel with the consumption of a ton of coal; and he (Mr. Mallet) had no doubt that, though the Bessemer process would always be regarded as a grand revolution in metallurgic art, the last process to which he had alluded, had a vast future before it. The great advantage of it was, that old wrought iron rails might be cut up, melted, and reproduced as cast steel.

Mr. LIVESEY stated that on the London and North-Western Railway many thousands of tons of steel-headed rails had been laid down, consisting of Bessemer steel welded to the body of the ordinary rail; but between the Bessemer steel and the ordinary rail there was inserted a puddled bar of very soft iron, and by that means they got an almost perfect weld. He knew several railways in this country on which the old rails were being replaced with rails with Bessemer steel heads welded as he had described. He had reason to believe that the steel-headed rail would supersede the solid Bessemer steel rail. He had heard that in America the solid Bessemer steel rails had given way to a great extent in severe weather, and it was thought they would have to fall back upon the steel-headed rail in preference.

The CHAIRMAN said, before proposing the customary vote of thanks to the author of the paper, he would briefly express his own opinions on the subject, and in so doing he was sure Mr. Rochussen would pardon him if he differed from him in some of the points brought forward. Mr. Rochussen had proceeded, as far as he (the Chairman) understood, on the principle of making the bearing surface and rail as rigid as possible; but as far as his own experience went—and he believed it was that of most engineers—there should be, as Mr. Mallet said, some elastic substance interposed to guard the necessarily stiff rail from the impulsive action of the engine and train that ran over it. Thirty years ago that was demonstrated almost to a certainty. The line between Manchester and Bolton was laid in the most rigid manner possible, the consequence of which was a continual fight between the railway and the locomotive, which thus became mutually destructive to each other. It was admitted that there must be elasticity, and the reason why there was the smooth motion over the line at Chat Moss, which had been mentioned, was because of the elastic base on which the rails were laid. Therefore he did not concur in the principle laid down by the author of the paper. He would not cavil at the multitude of parts constituting the permanent way, or at his ingenious contrivances for securing the rail, so as to diminish the expense of his system; but for his own part, he thought that this complication produced more harm ultimately than was counterbalanced by the saving of expensive material. He had yet to learn, and he feared Mr. Rochussen had not sufficiently considered, what would be the effect under severe traffic of the bearing of the steel rail-head upon those narrow supports. The last speaker alluded to what was going on on the London and North-Western Railway; but perhaps he was not aware that for the last few years the specifications for the manufacture of rails had usually been that the hardest material should be put at the top, and the base should be formed of fibrous iron. The highest point of excellence at which that system had arrived was the substitution of steel for the top of the rail, and practically they had now the means of connecting the steel top with the base and sub-base of the rail by welding, in a manner more simple than that described in the paper, and without involving its many complications. With respect to the question which had been asked by Mr. Danvers, why wooden sleepers were to be abandoned, he (the Chairman) would say that his old-fashioned notions led him still to be an advocate for wooden sleepers. He thought when they looked in the first place at the admirable simplicity of a fished rail, without chairs, laid upon wooden sleepers, and considered the first cost of that system, and also of its periodical renewal; and when, in the second place, they calculated how much more capital had to be expended in laying down one of these expensive iron systems, they would find, spreading

the cost over a number of years, that the wooden system was the more economical. He had found in South America, and especially in Bahia, a hard wood, which resisted the white ant provided it was cut at the proper season. He found that the cost of sleepers of that wood was very little more than the softer wood imported. With respect to India, he might state that 20 years ago he had the honour of reporting to the East India Company upon the introduction of railways in India, and he recommended at that time that the harder woods of the country should be employed as sleepers, because it was well known that if certain hard woods were cut at the proper season, they would resist the white ant, and last for eight or ten years. Moreover he had known creasoted timber to last for fifteen years without the least decay. He had tried the iron pot sleepers; wherever there was sand and perfect drainage, those sleepers succeeded, as, for instance, in Egypt, but if the ballast was composed of broken stone or clay, they gave way. The Chairman concluded by proposing a cordial vote of thanks to Mr. Rochussen for his paper.

The vote of thanks having been passed,

Mr. ROCHUSSEN, in acknowledging the compliment, said he had brought this paper before the Society simply as a record of what had been done in Germany. He confessed he thought, when he first saw some of these plans, they could not answer, but experience had shown that they were at least worthy of some consideration. The compound rail had been in use in Germany 15 years, and it was found to be a step in advance, and upon that the systems he had just explained were in some respects founded. But perhaps they were more applicable to hot climates, where suitable wood for sleepers was difficult to be obtained. The system of steel making described by Mr. Mallet was not new in Germany, for a manufactory had been established in Westphalia which produced the same results, though by somewhat different means.

PARIS EXHIBITION, 1867.

To the general regulations published by the French Imperial Commission was appended a table of dates assigned for the termination of the various stages of the undertaking; the building was to be completed by the first day of December, and the installations of exhibitors by the fifteenth of January. As regards the building, there was a pretty general feeling that the promise could not be kept; but although the hammer still rings in the great temple of industry, and the paint brush has still a vast amount of work to do, the Imperial Commission virtually kept its promise, for all has been done that was actually necessary for the purposes of the exhibition. Workmen are now completing what may be called the extra portions of the building, such as the projecting roofs over the four main entrances, the grand vestibule, and other parts, but all the industrial courts—or galleries, as they are called, in the sense of the application of the word to picture galleries, which may be on the ground-floor, as those of the new Exhibition all are—were completed and glazed, all the avenues and passages laid in cement, and ready for the fittings to be erected about the time specified. This is a fact which deserves to be recorded, and which holds out the best possible guarantee for the fulfilment of the remaining promises of the programme. The amount of work that has been executed, and the regularity with which all the various operations have proceeded, reflect the greatest credit upon the directors of the undertaking, and have called forth the admiration of all who have visited the works from time to time.

A simple statement of what has been done, and is now in hand, will be the best comment. Commencing, then, with the outer zone or gallery—the great machinery and processes court—workmen are finishing the great windows over the entrance doors, as well as the arcades below, and the projecting *marquises*, or roofs, for the convenience of visitors; painters are swung by hundreds just beneath the huge roof, covering the dusky iron with a tint of light chocolate or coffee colour, and picking out the lines and rivets with vermilion and white; glaziers are filling in the windows as fast as the iron men leave them, and the whole enormous area below is cleared. Along the entire centre of this enormous circular gallery is a double row of cast iron pillars, about 15 ft. high, and 8 ft. apart, joined together by longitudinal and transverse lattice girders, and having large brackets standing out on each side; these brackets are to receive the shafts for the conveyance of power to machinery in motion; and on the girders above is being constructed a gallery, which will be about 10 ft. wide, and will enable visitors to pass along the entire length of the machinery court, and survey the Exhibition on each side with advantage. As this gallery occupies no space that could otherwise be appropriated, it will be a clear gain to the public. There will also be a passage below between the pillars.

In some parts of this court the foundations for heavy machinery are being prepared, and it would be well that those who have much to do in this way should lose no time; they can work now without interruption, whereas shortly this will not be the case. In the British portion of the machinery court some partition walls have been run up, which indicate that applications for space in this court have been more numerous than in the alimentary gallery beyond, some portion of which is thus taken into the former.

Proceeding inwards to the industrial galleries, called intermediate, as lying between the greater outer zone of the machinery court and the fine-art galleries of the centre, we find the carpenters busily at work in all directions; on the French side a great amount of wood-work is completed, and more under hand; in several classes the courts are not only formed, but nearly the whole of the framework of the cases is in position, and might be finished off, as regards carpenters' work, in a few days; the high partition walls required for the tapestry of the Gobelins and other manufactories are partly completed, and almost every portion of the French industrial courts is under hand. It is nearly the same in most of the other foreign courts; each country is being fenced off from his neighbour, and getting his main wood-work in place; the limits of Northern, Southern, Eastern and Western Powers are defined. Russia is indicated in one place by a characteristic pierced wooden railing, with heavy corner posts, mounted on stone pedestals, which will form the limits of the courts belonging to that country. Proceeding on the tour of the building, we traverse the small countries, or rather the small spaces devoted to the vast countries of China, Japan, Mexico, South America, &c., and arrive in the department of the United States, where the carpenters are hard at work. The remaining portion is devoted to Great Britain; here the sappers are now marking out the floor, and there is nothing to hinder the immediate erection of partitions, stands, and cases.

It was said that portions of the floor were to be covered with asphalte, but this appears to have been an error; at any rate there is no appearance of the asphalte furnaces; and the deliverance from its stifling fumes must be a source of satisfaction for all engaged in the building. The whole of the exhibiting space in the intermediate galleries is floored with wood, and the work is well done. The avenues and passages are all laid in cement, or in what is called *béton aggloméré*, which presents no difference to the eye or the foot.

The fine-art galleries, which form the inner ring, are not quite finished, but will be very shortly; the roofs have all been glazed for a considerable time; the floors of the larger gallery—that appropriated to the fine arts pure, painting, sculpture, architecture, &c.—are laid in cement, while the gallery of the history of labour, or retrospective museum, has an oak floor. The walls

of the greater portion of the fine-art gallery have been covered with wood, papered, and coloured a Venetian or Pompeian red. Suspended from the ties of the roof are semi-opaque screens, or false ceilings, to moderate the light; in the department of the gallery situated in the straight portions of the building, the effect of these screens is agreeable, and they present nothing remarkable to the eye, but in the curved portions of the gallery—and all the British fine art gallery is in the circular part of the building—the effect of these screens is most disagreeable; the first thing seen on entering the room is this screen, which looks like a huge comma dropping from the ceiling, with its tail running round the corner. It is to be hoped that a false ceiling of muslin, stretched from wall to wall, or some other mode of moderating the light will be adopted by the British Commission.

The retrospective gallery is in nearly the same stage of advancement as the preceding, and in the French portion cases and stands are already being got into place here and there. The entrances of the compartments of this gallery are being fitted with solid doors, which run upon rods, and can be firmly secured by lock and key, so that this rich collection will at night require no watchman, and yet be perfectly safe from depredation.

Within these galleries is the central garden, with its terrace and broad verandah all round. The face of the wall towards the garden has been plastered, the upper portion being decorated with a frieze of red marble, relieved by green marble and some slight ornamentation over the doors of the principal avenues. The verandah is quite finished, with the exception of the last touches of the painter.

It may be mentioned that in the French department the classes are all painted upon the pillars in the industrial galleries, while in the other portions of the building the names of the various exhibiting countries are exhibited over their locations. The radial avenues, as well as the concentric passages, are being covered, experimentally, with a white awning, with a coloured scolloped border, which has a very good effect.

Quitting the building we come to the alimentary class under the great *marquise*, or verandah, which encircles its outer iron wall. The fronts of cafés and restaurants on the French side are fixed in their place; a space is being prepared for the medical attendants, and the terrace or promenade under the verandah is being cemented. It is to be hoped that arrangements for refreshment will be made here for the exhibitors and others during the arrangement of the contents of the exhibition. The Russian restaurant is also in hand.

The Imperial commission has just taken possession of its rooms in the large house built for the accommodation of the executive officers and juries.

In the garden, the royal pavilion of Great Britain is rising rapidly on the spot opposite to the Oriental building erected for the Emperor of the French; it is a solid construction of stone, relieved with red bricks, having three sharp pointed roofs, one transverse and two longitudinal, and containing three apartments, a large one in the rear and two smaller ones in front. Not far from the royal pavilion is the English boiler house, with a noble chimney shaft; the latter is finished, as well as the foundations, but not the superstructure, of the former.

A very useful feature of the arrangements is a covered way, which leads from the railway station just beyond the limits of the grounds to one of the side doors of the building itself, so that all who arrive by rail will be under shelter the whole way; this covered way is nearly finished, and will shortly be connected with the entrance by a vestibule. On the other side of the building is another large covered way for carriages to pass under and set down their occupants.

Speaking of railways, it may be mentioned that an iron tramway for the service of the exhibition is now being laid round the building, inside as well as outside, with a branch leading to the special exhibition railway, which will communicate with all the main French lines.

The arrangements for the horticultural exhibition and the great aquariums, as well as those of the various commissions, are being carried out steadily, but it will be more convenient to speak of these in a future number.

Beyond the exhibition grounds, the steel bridge, which crosses the opening made in the quay, is completed; a large and convenient landing place is being formed for those who arrive by water, and who may enter the grounds of the exhibition either by the way beneath the bridge or by the main entrance in the quay. On the right and left of this landing place, but on a level with the quay, two large restaurants have been erected, and one of these will, it is said, be under the direction of two well-known English caterers.

POPULAR EDUCATION IN GERMANY AND SWITZERLAND.

The following is a further communication from Mr. Joseph Kay to the *Manchester Examiner and Times*, in addition to the one which appeared in the *Journal* for the 11th January:—

Will you permit me to conclude the slight sketch I have offered you of the progress of the education of the people of Western Europe, by describing shortly what the people themselves are doing for the education of their children in the purely democratic cantons of Switzerland.

But let me first remind your readers, that even in those German states in which the greatest progress has been made, the work of national education has been earnestly commenced only since 1820, when these countries were beginning to recover from the terrible consequences of the Bonapartist wars.

Prussia and Saxony were the first to treat the education of the children as a national duty. They were the first to devote the power and the resources of the state to the serious promotion of their work.

They have done much more for its development than any other German state. But even Prussia and Saxony only commenced this work after 1820, and one great motive which induced the Prussian government to do so was the desire to improve the mental and physical condition of the classes from which the ranks of the army were mainly recruited, and so to render the nation better fitted to contend with its powerful neighbours. How wise this policy was the war of last year has shown.

The other German states slowly followed the example of Prussia and Saxony. All the principal states have now put these laws in force, but in some, as in Hanover and Bavaria, the work has been too recently commenced to allow us, as yet, either to look for great results or even to expect that the effects of the previous state of ignorance and neglect have been entirely overcome.

In Prussia and Saxony, however, one-sixth of the whole population is under the care of educated teachers.

In Prussia alone, in the year 1861, there were:—3,096,546 children in regular daily attendance at these schools; 25,969 primary schools, many of them containing five or six class-rooms; 46,227 teachers, all of whom had been specially trained for their duties. These results had been obtained between the years 1820 and 1861.

But, remarkable as these statistics of the great German kingdom are, it is even more interesting to observe what is being effected in Switzerland, because the governments of the 22 cantons of that country are the purest possible forms of democracy. All the adults vote in the election of the members of the cantonal governments of the federal parliament. Nearly all the land belongs to

the peasant farmers. There are scarcely any great proprietors. There is no titled class. There is no state church.

I merely mention facts. I am not arguing in favour of democracy. I want to show what the people themselves have done, under such a state of political circumstances, for the education of all the children of the nation.

Up to 1832 the cantonal governments were more or less oligarchical, or under the influence of a small wealthy class. About 1832, the old and more aristocratic forms of government were overthrown, and the present purely democratic system was substituted.

Now, the great development of the education of the people in Switzerland began in 1832, after the overthrow of the more aristocratic forms of government. And it is a curious fact, that since the Swiss people have actually governed themselves, they, the most purely democratic people in the world, have done more for the education of all the children and youth of the nation than any other country in the world.

But here again it is necessary to remind your readers that the inhabitants of some of the cantons are Protestants and of others Romanists. The Romanist cantons did not commence the work of national education in any earnest spirit until a few years ago. They have not, therefore, made nearly so great a progress as the Protestant cantons. But now, both Romanist and Protestant cantons have put in force the laws I am going to describe.

Every Swiss parent is obliged by law to satisfy the local authorities that his children are being properly educated, either at home or in some school of the parents' selection, from their fifth to the end of their fourteenth, and, in some cantons, to the end of their sixteenth year. The Swiss consider the proper care and education of the young to be a matter of such vital importance for the best interests of the nation and of the people themselves, that they are most rigorous in the strict enforcement of these laws. In the best educated cantons no children are neglected. The physical, moral, and religious training of all—even the poorest—are most carefully fostered and watched over by the State.

In the manufacturing districts, the children are allowed to begin to work in the mills at the age of twelve or thirteen, on condition:—1. That they obtain from the school inspector a certificate that they are able to read and write. 2. That they continue to attend the school classes a fixed number of hours every week, until the completion of their 15th or 16th year. The local authorities are, as I mentioned in a previous letter, empowered:—1. To raise the school rate. 2. To provide schools, teachers, and play grounds. 3. To maintain and furnish the school buildings. 4. To provide all necessary apparatus. 5. To pay the teachers' salaries. 6. To provide houses and gardens for the teachers. 7. To supply the children of poor parents with decent clothing for school attendance. 8. To warm and light the schoolrooms. 9. To pay the school fees for poor children.

All these matters are subjects of distinct legislative provisions.

The town schools often contain five or six class-rooms, each superintended by an educated teacher. In these so-called primary schools, the children of nearly all classes of society begin their education. I remember being sent by the mother of a rich Geneva banker to see his young children in one of the class-rooms of a village school in the canton of Vaud. Besides these primary schools, the Swiss establish in each town one or more of what they call secondary schools. In these, a superior classical, mathematical, and scientific education is given by professors from the universities. In these secondary schools the children of the richer classes continue their education. But even in them, places are provided for poor boys who distinguish themselves in the primary schools, and who wish to educate themselves, either to be teachers or for some business requiring scientific knowledge.

I have seen in these secondary schools in Switzerland the clever sons of working men being educated at the expense of the country in science, mathematics, drawing from models, designing, &c., in the same classes with the children of richer parents.

All parties in Switzerland, Romanist and Protestant, rich and poor, combine—

1. To save the children from the streets. 2. To train them up in clean and healthy habits. 3. To teach them the principles of their parents' religion. 4. To give them as good an education as can be imparted between the ages of five and sixteen. 5. To aid clever children to continue their education after leaving the primary schools, if they show any peculiar ability.

But to do all this, it was absolutely necessary to train good teachers. For this purpose the people of these democratic cantons have taxed themselves to establish and support 13 admirable colleges for the education of teachers.

No person is allowed to officiate as a teacher in Switzerland until he has obtained—

1. A certificate of education from the examiners appointed by the government of his canton. 2. A certificate of character from his religious minister. 3. Certificates from the professors of the college where he was educated, of his fitness to be entrusted with the education of children.

I visited the teachers' cottages at Lausanne, on the Lake of Constance, in Argau, in the Canton of Berne, at Hofwyl, at Fribourg, St. Gall, Zurich, and Solleure.

The students for the thirteen colleges are selected from the candidates for admission. The education given in the colleges comprises—

1. History. 2. Geography. 3. Mathematics. 4. The elements of the physical sciences. 5. Music and singing. 6. Drawing. 7. Farming or gardening.

To nearly all these colleges are attached farms and gardens. The students work like peasants on these lands, under the guidance of skilled men. They learn how to cultivate and manage a farm, how to cultivate a kitchen garden, and how to prune trees. This work invigorates their frames, accustoms them to humble toil, makes them understand the labours and habits of the peasant farmers, cultivates in them a sympathy for the people among them they will have to live and labour, and prevents the high intellectual training of the college from unfitting them for their humble duties in the village. Besides this, they thus acquire in many of these colleges a scientific knowledge of the business of the people among whom they will have to spend their lives. This enables them to be useful to the parents of their chidren, to win their respect, and to disseminate among them knowledge which is advantageous to them and the nation.

The students remain in these colleges two or three years. The expenses of their board and education are borne by the government. The life in the college is so arranged or ordered as to prepare the young men for their humble lives in the villages. The young students are, therefore, during their life in the college, accustomed to simple fare, to the dress of a peasant, and to humble and arduous duties, while they are receiving a high intellectual training. They are made to clean the rooms of the college, to take care of the sleeping rooms, to cultivate and prepare the vegetables for the meals, to serve by turns at the tables, and to work like labourers upon the farm attached to the college. The consequence is, that, when they go into the villages as teachers, they find themselves thoroughly accustomed to the humblest duties and associates. They find their work in the villages less laborious than their life in the college, and this makes them contented with their position.

The teachers in Switzerland are the helpmates of the religious minister, the guardians and trainers of the children, and the friends and enlightened associates of the farmers and peasants. If this is true, do you wonder that the Swiss are willing to lavish such large funds upon the training of the teachers of their children?

In the canton of Berne, which has a population of between 400,000 and 500,000, the democratic government had provided three of these colleges. The most interesting college was the one which was managed, at the time of my visit, by that good and earnest man Vehrli.

My brother, Sir James Kay-Shuttleworth, was the first to introduce this institution to the knowledge of Englishmen. After he had been there, I visited Vehrli several times. About a mile from the gates of the old city of Constance, in the canton of Thurgovie, upon a rising ground overlooking the great inland sea, stands an ancient turretted mansion, which was formerly the palace of the abbot of a vast convent, the buildngs of which still remain.

The democratic government of the little canton of Thurgovie had set apart the abbot's palace, with a good farm surrounding it, for the purpose of a college for the education of the teachers of the canton. Such a change had that old magician—Time—effected in the uses to which the old palace was devoted. It was all furnished in the simplest possible manner. The chairs and tables were of deal. The linen was coarse, but clean. The rooms, so far as the furniture was concerned, might have been the rooms of a poor peasant's cottage. But the books in the class-rooms, the diagrams of the last mathematical lessons chalked upon the blackboards in the lecture-rooms—the maps on the walls—the models—the objects for the scientific lessons—the drawings of the students—the music books—and the musical instruments, all tell the visitor most forcibly that the instruction given to the students formed a strange contrast to the simplicity of their daily life. When Vehrli joined me, he was dressed like a peasant, but his eyes and face told of the intelligence which was presiding over this far-famed institution. The students were in the fields working like farm labourers, under the direction of scientific men. I afterwards saw them preparing the vegetables for the mid-day meal. These young men could nearly all play some musical instrument—the organ, pianoforte, or violin; they could nearly all sing from note, and all those who had been two years in the institution were admirably qualified to take the management of the primary schools.

Vehrli said, "In our college the students do everything for themselves. They clean their own chambers, brush their own boots, clean the knives, forks, and dishes, cultivate all the vegetables, prepare them to be cooked, and serve the meals. But, notwithstanding all this, they work in their class-rooms eight hours every day, and study the Scriptures, history, geography, arithmetic, mathematics, the elements of the sciences, music, and drawing." Close to the College there was a large village school, under the care of an experienced teacher. The students at the College, during their last year's residence, practised teaching in this school under the guidance of the teacher.

Within a few miles of the College were two large agricultural schools, founded and supported by this little canton, where the sons of the small farmers spend a few months every year to learn scientific farming and agricultural chemistry. They were under the management of scientific professors. Farms were attached to them. They were supplied with laboratories, the best agricultural implements, and books.

Throughout Switzerland, a good many of these agricultural schools have been established, in order to spread a knowledge of scientific and economic farming among the people.

But what I want to impress upon those who read this letter is, that the poor peasants and workmen of Switzerland have such a profound sense of the benefits which a good system of training and education bestows, that they do not grudge the great expense of carrying out and perfecting, as far as possible, the system of education which I have attempted so imperfectly to describe.

In Switzerland, it is the people who have most stringently enforced the laws which *compel* a parent to educate his children. It is the people who bear all the expense of assisting poor parents to do so. It is the people who provide the costly teachers' colleges, who build the schools, furnish them, maintain them, appoint the teachers, pay them, supply them with houses, and support them when superannuated. And so far are the people from murmuring at these regulations, that one of the principal efforts of the democratic governments of these little cantons is, how they shall further develope and perfect the institutions and laws, which have for their object the nurture and improvement of their children.

Do you wonder, then, when I tell you, that in several of the Protestant cantons, one in five, or one-fifth of the whole population, is actually under the care and education of the teachers? Every one in these cantons agrees that the good effects of the schools upon the moral and physical well-being of the people are most marked. The houses are steadily improving. The habits of the people are becoming more and more refined. The health of the younger generations is improving. All who live among them mark the change.

I believe that the workmen and peasants of Prussia, Saxony, and the Protestant cantons of Switzerland are in a better moral and social condition than the workmen and peasants of any other European country. And it is a fact, which I commend to the consideration of your readers, that during the last thirty years more has been done for the education and training of the children in these countries than in any other country in the world.

None are left neglected in the streets and gutters. All are trained up in the way they should go. And, certainly, the truth of the wise old saying is being exemplified in the case of these nations.

Fine Arts.

Portrait Miniatures.—Photographs from 200 of the most important of the miniatures exhibited in 1865 at the South Kensington Museum are now, under the sanction of the Science and Art Department, published by the Arundel Society. The complete set, with a copy of the official catalogue, bound in three volumes, half-morocco, is sold for ten guineas; a packet of twenty-five portraits, at choice, for one guinea; or a single photograph for one shilling. Specimens may be seen either at the South Kensington Museum, or at the rooms of the Arundel Society, 24, Old Bond-street.

National Portraits.—The exhibition of historic portraits, held last year at South Kensington, is put on permanent record by the art of photography. Out of 1,030 pictures exhibited, 964 have, with the consent of the owners, been photographed. The entire collection is issued by the Arundel Society, under the sanction of the Department of Science and Art, in ten volumes, half-bound in morocco, at the price of £62; or a single volume of 100 portraits, at choice, may be obtained for six guineas; or a packet of sixteen portraits for one guinea, or a single portrait for 1s. 6d. Specimens to be seen at Kensington or Old Bond-street. A new and corrected edition, with indexes, of the official catalogue of the late National Portrait Exhibition is announced, also a classified list of all photographs of drawings, paintings, and sculpture issued by the Department of Science and Art. This list, brought down to the present moment, will be of much use; a former catalogue has been out of print for some time.

Photographs of Pictures in the National Gallery.—Messrs. Caldesi have for some months been engaged on student-days in making photographs from leading pictures in the National Gallery. Upwards of three hundred plates have been pronounced satisfactory. It is thought that arrangements may be made for the publication of a complete work on the National Gallery,

consisting of a historic account of the painters, and a critical estimate of the pictures, illustrated by these photographs. The want of such a work has been long felt. Most of the national museums on the Continent have received elucidation in handsome and well-known volumes. Now that the National Gallery contains an epitome of most historic schools, a work which will worthily set forth its treasures would form a valuable contribution to art-literature.

Manufactures.

MANUFACTURES OF VENICE.—Till the end of the year 1847 there were upwards of one hundred different industries in a flourishing state. The glass manufacture alone produced yearly 800,000 kilogrammes of glass and crystal ware. The celebrated paper-mills produced upwards of 2,320,000 kilogrammes, and gave employment to 3,000 workmen. The salt marshes of the Lagoons produced more than 25,000,000 pounds of salt. Upwards of 260,000 pounds of the best wax candles were manufactured yearly. Extensive manufactures of painters' colours were carried on, and yearly furnished 470,000 pounds of white lead. The tobacco manufacture gave employment to 300 workmen and 600 women, and produced the enormous quantity of 23,000,000 lbs. only in cigars. The leather manufacture produced the best morocco, which was exported to the Levant; and in America upwards of 1,000 workmen were employed in the manufacture of gloves. In the arsenal a great number of ships were constructed, and the private shipbuilding yards alone employed 700 workmen. The manufacture of sail-cloth, fez of red cloth for the Levant, passementerie and lace, still maintained for Venice her ancient wealth. Even the ancient industry of masks for the Carnival produced upwards of 100,000 per year, which were exported throughout Italy, Germany, Switzerland, and as far as America. Exquisite articles of jewelry were still manufactured, amongst which may be remarked the little chains that derive their name from Venice, and gave employment to about 200 jewellers. From 1807 to 1847 a quantity of silver and gold, to the value of £6,440,000 sterling, was coined by the mint of Venice for the Levant. About 5,000 vessels yearly entered the port of Venice. The value of the exports by sea amounted to £5,720,000, and those by land to £2,800,000. Such was the commercial prosperity of Venice till the close of 1847. Twenty years are already passed, and Venice has with difficulty struggled on. It is to be hoped now that that she will rise again from her sleep, and become once more a great commercial centre.

Commerce.

SUGAR IN PERU.—In Peru, at the present time, the sugar cane is cultivated, and sugar refineries are established upon the best principles, if we may judge by the produce. The refineries furnish a white sugar, of fine quality, in small crystals. The flavour of it partakes more of the date than of the cane. If a like quantity of sugar could be produced on a scale of any magnitude, no doubt a large commerce would arise, although the great distance of the place of production might prevent this article of food from coming into European markets.

SALT WORKS IN FRANCE.—There are now numerous salt works on the French shore of La Manche. The most important working in these parts has been for some time past that of Bouteillas, near Dieppe; it was named in a charter at the end of the 17th century. Now, what remains of the salt marshes upon the French coast occupies a superficial total of 24,248 hectares, distributed over the coasts of the Manche, the ocean, and the Mediterranean. The cost price of the salt averages a franc for 100 kilogrammes.

KAOLIN.—Cornwall has for some years past done a large and profitable business in china clay, the greater part of which has been raised in the St. Austell district, where several important works are now in progress. There is every prospect, however, of a new district being opened up on an extensive scale in a short time. Fine samples of china clay have been discovered in three parishes, and the ground in various localities is believed to be very rich. Steps are being taken with a view to establish works which would afford employment to a large number of people.

Colonies.

COLONISATION OF VICTORIA.—A colonial journal says:—"It appears from the reports that have been made public lately, that the efforts of the Parliaments and Governments of Victoria, for some years past, have not been very successful in placing a race of yeomen on the soil, although heavy public losses have been endured for that end. None of the modes under which land has been offered to the public seem to have attracted settlers, in any number, who have really become settlers of the soil. Under the system of auction, which preceded that introduced by the Nicholson Act, considerable tracts of land were disposed of, but it was only in isolated districts here and there that the farmer put his hand to the plough. Magnificently-grassed lands, which would carry good crops of cereals under any ordinary course of farming, remain, year after year, in the same state, pretty to look at but not so charming as if fields of ripe yellow grain alternated with green crops and fallow fields. There were two causes for this state of things. The really good land in the colony, apart from that which may be found good, but is at present heavily covered with timber and almost impenetrable scrub, is too small to attract a numerous body of farmers, who might have worked together for their mutual good. Towns did not exist, except on the coast, or on new rushes in the gold field districts, to furnish markets for produce. The pastoral tenants were content with the natural bush roads, over which their bullock drays travelled easily enough under easy loads, and thus the farmer had no temptation in roads or markets to place land under cultivation, especially while the cheap and convenient highway of the sea enabled the farmers of South Australia and Tasmania to throw their produce into the markets of the gold fields. Scarcity and dearth of labour, uncertainty of seasons, and various other causes, assisted to discourage the farmer. The Amended Land Act has not been much more successful in attracting farmers. It is asserted, on what appears to be good evidence, that taking all the areas together thrown open for selection in and since June last, and they embrace about 4,000,000 acres, not more than a tenth part of the land has passed into the hands of *bonâ fide* farming settlers."

Obituary.

MR. GEORGE BAXTER, the inventor of oil-colour picture printing, died on Friday, the 11th January, from apoplexy, in his 62nd year. Mr. Baxter was a native of Lewes, and came to London forty years ago. He invented the process of oil-colour printing, and was in some repute as an artist. Among some of his works may be mentioned his miniatures of Her Majesty and the late Prince Consort, and a copy of the Descent from the Cross, from the original at Antwerp. He received the gold medal of Austria for his opening of the "First Par-

liament of Queen Victoria" and the "Coronation." His best original production is the miniature drawing of the Baptism of the Prince of Wales. Mr. Baxter was formerly a member of the Society of Arts.

VICTOR COUSIN, whose philosophical works have occupied great attention during the last thirty years, died recently. He was the son of a Parisian watchmaker, and was entirely the architect of his own fortune. He filled for a considerable time the historical chair in the University of Paris, and was a member of two branches of the Institute, the Academy of Moral and Political Science, and the Academy of France. M. Cousin's library was celebrated, and estimated to be worth a million of francs; this is left by will to the Sorbonne. The intention of the deceased was known some time since, and in recognition of the fact, and as a tribute to his reputation, the government recently named a new street after him, Rue de Victor Cousin. M. Cousin resided at Cannes, where he died.

MR. JOSEPH GUY, author of the well-known Spelling-book, and of various elementary educational works on history, geography, and various branches of science, died on Saturday, the 19th inst., at the age of 83.

CAPTAIN HUISH, well known from his long connection with the London and North-Western Railway Company, died on Friday, the 18th inst. Captain Huish was deputy-chairman of the Electric and International Telegraph Company.

Notes.

THE ORPHEONISTS.—It appears from official reports that there are now in France 3,243 musical societies called orpheonists, consisting of 90,532 active members and 56,967 honorary members, altogether 147,499 persons. The greater part of these choral societies are under the direction of a professional teacher. The Departments du Nord and des Bouches-du-Rhône are those where the choral societies are the most numerous.

STORM SIGNALS.—It appears that the underwriters, ship-owners, and members of the mercantile marine service in Liverpool have expressed the greatest dissatisfaction with regard to the cessation of the storm warnings which were inaugurated by the late Admiral Fitzroy, and have adopted a memorial to the Board of Trade, asking that they may be re-established at once.

RUSSIAN TELEGRAPHS.—The city of St. Petersburg will soon be provided with a telegraph which will convey the messages of the Government and those of private persons from all parts of the city, and even from some of the most frequented suburbs. Already the wires are laid, and the stations are now being organised; fourteen will be provided for the city and two for the environs. A message of twenty words will cost forty copecks; stamped sheets, on which the message can be written, and adhesive stamps, will be sold at all stations.

MINIATURE COINAGE FOR THE ISLAND OF MALTA.—It appears by the *Engineer* that "a coinage of a very peculiar and curious character is at present in course of production at her Majesty's mint, consisting of minute pieces of money, each of which is intended to circulate among the inhabitants of Malta at the the nominal value of one-twelfth part of our English penny, or one-third of a farthing. Of these infinitesimal specimens of British mintage no less than half-a-ton weight, or a little over half-a-million of coins, have already received their impressions, and they will be speedily forwarded to their destination. Apart from their remarkably small size and value the new coins possess characteristics which make them interesting. For example, the portrait of the Queen, which forms the main ornamentation of the obverse, is said to be the most correct likeness of Her Majesty that has ever been transferred to metal discs. It is the result of a very recent sitting accorded to the artist, Mr. Leonard C. Wyon, who also engraved the die. The 'one-third farthing' is composed of metal analogous in its nature to that of which our own subordinate coinage is made, namely, a mixture of copper, tin, and zinc, in the respective proportions of ninety-five, three, and two parts in the hundred. This forms an exceedingly hard composition, well calculated to resist the wasting effects of attrition; and the pieces when newly struck have a rich, golden colour. The coins are five-eighths of an inch in diameter, and exceedingly thin. In fact, they might be termed metallic wafers, for it actually requires 480 of them to weigh down 1 lb. avoirdupois, and thirty of them to balance an ounce. In addition to the royal portrait, which is laureated and uncrowned, and which shows the hair plaited at the back—the obverse bears the legend, 'VICTORIA D. G. BRITT. REG. F. D.,' within the engrailed edge, forming the frame of the picture, so to speak. The reverse represents a wreath composed of two sprays of the British oak, and between which, at their upper terminal points, is placed an imperial crown. Within the wreath, in straight lines, appear the words, 'One-third farthing,' and the date. The protecting rim, considering the paucity of material for raising it, is boldly developed, and thus the coin gains a finished appearance, contrasting favourably with the wire-edged pieces of money of far higher value and greater pretension. It is difficult to imagine, in these times of dear provisions and heavy rates and rentals at home, what articles the Maltese may be able to purchase for the 144th part of a shilling, but as figs, honey, oranges, and fish are abundant in the markets of Malta, perhaps some of these delicacies are obtainable at that homœopathic price. 'Change for a sovereign' in the new coinage would place the receiver in the possession of no less than 2,880 distinct pieces of hard cash. It remains only to be said that so far as minting operations are concerned in the execution of this especial coinage, they are both more numerous and more costly than those required in the production of sovereigns. Standard gold is far more ductile and 'kind' than bronze, and therefore more easily manipulated. Literally it costs less to make a sovereign than a Maltese wafer coin, notwithstanding the marvellous disparity in their respective values."

Correspondence.

MERCHANT SEAMEN.—SIR,—With reference to a proposal that was made at the discussion upon Capt. Toynbee's paper last Wednesday evening, that either another evening should be appointed to continue the discussion, or a committee formed to consider the state of the law with regard to merchant seamen, and as it may be inconvenient to fix another evening before the question is brought before Parliament, great good might be done were a committee formed to report to your council upon the subject. The point that struck me most at the discussion, and even in Capt. Toynbee's paper, was that the Merchant Shipping Act, which is very voluminous, appeared to be so little known. There is scarcely a point that was touched upon that it does not provide for, so that it is not an alteration in the law that is needed to effect all the improvement that is sought, but merely some changes in the mode of carrying out the provisions of the Act; and one clause permits the Board of Trade to make alterations and amendments even in the Act itself. I mention this for I fear that we should not readily get a better Act for the sailor if a new system of legislation is begun. It is from the Board of Trade and not from Parliament that most good can be got by proper representations. In the few observations I made (which are put down to the Rev. John Scott), I stated that the worst evil sailors had to contend with was that there was one particular spot appointed by Government at which

sailors receive their pay in London (irrespective of the sailors' homes), therefore the crimps and others are guided to their prey. The sailors are anxious that this should be done away with, and that they might receive their wages in the presence of a shipping master on board their ships. The Act admits of this, but it is never the practice; indeed the Act is most carefully framed for the good of the sailor, and yet for doing justice to the shipowner. I need not enter into further particulars, but, both as a member of your Society, and as one in constant communication with all classes of sailors, I shall be glad to be of any service to the committee if there is one formed. I may state that previous to taking holy orders, and undertaking the work here among sailors at the request of the bishop, I had many years' experience with ships and sailors as a partner in one of the oldest houses in China, where I was interested in many fine ships, and I have been both a shipowner and underwriter.—I am, &c., John Scarth.

Gravesend, Jan. 22, 1867.

MEETINGS FOR THE ENSUING WEEK.

Mon......R. Geographical, 8½. 1. The Hon. George Campbell, "A Geographical inquiry with reference to the best site for a Capital of India." 2. Mr. C. R. Markham, "On the Inland Navigation of Travancore."
Entomological, 7. Annual Meeting.
British Architects, 8.
Actuaries, 7. "On the real Rate of Mortality prevailing in England and Wales during the One Hundred Years from 1761 to 1861."
Medical, 8.
London Inst., 7. Prof. Ansted, "On the Present Aspect of Geology."

Tues ...Civil Engineers, 8. Discussion on "Ships of War."
Royal Inst., 3. Prof. Tyndall, "On Vibratory Motion, with special reference to Sound."

Wed ...Society of Arts, 8. Report from the Judges on the Art-Workmanship Competition.

Thur ...Royal, 8½.
Antiquaries, 8½.
Philosophical Club, 6.
Royal Inst., 3. Prof. Tyndall, "On Vibratory Motion, with special reference to Sound."
London Inst., 7. Prof. Wanklyn, "On the Chemistry of the Noble Metals."

Fri ......Philological, 8.
Royal Inst., 8. Mr. J. Scott Russell, "On the Crystal Palace Fire."
Archæological Inst., 4.
R. United Service Inst., 3. Capt. R. C. Noake, "The Best Mode of Recruiting for the Army, and the Influences bearing upon that Service."

Sat ......R. Botanic, 3¾.
R. Inst., 3. Mr. G. A. Macfarren, "On Harmony."

Patents.

From Commissioners of Patents' Journal, January 18th.

Grants of Provisional Protection.

Baths, &c., heating—3438—G. Shrewsbury.
Boots and shoes—3381—W. Clark.
Boots, &c., beading the uppers of—3343—W. Chapman.
Breech-loading fire-arms, and cartridges for—3425—F. J. Manceaux.
Button-hole sewing machines—8—G. B. Woodruff and G. Browning.
Carriages—3418—A. V. Newton.
Cartridges—24—G. Haseltine.
Chlorine—3411—H. B. Condy.
Clocks—3446—J. T. Griffin.
Cocks—3409—W. H. Cutler and T. Brown.
Coke and charcoal—3419 - H. Chamberlain.
Combs—4—G. Stuart.
Corks - 3341—W. Gilbey.
Culinary vessels—3427—E. B. Sampson.
Dredgers—3421—W. Simons and A. Brown.
Drying apparatus—3408—A. V. Newton.
Electricity, generating—3394—C. and S. A. Varley.
Electric telegraph posts, supports for—16—G. B. Smith.
Fabrics, folding—12—J. C. Ellison.
Fabrics, treating—3415—J. E. Brown.
Fibrous material, cleaning—3365—W. Rowan.
Fibrous substances, carding, &c.—3387—F. A. Calvert.
Flax, rippling—3444—C. D. Abel.
Fire-arms, breech-loading—28—P. Dagnall.
Fires, lighting—3347—W. Baker.
Glass, &c., cleaning—3423—W. B. Berrey.
Gossamer hat bodies—3353—S. Hall.
Grain, drying—3377—A. S. and H. H. Ayre.
Graining—3369—S. Jacobs.
Hydraulic power, applying—3395—J. B. Jordan and J. Darlington.
Hydrogen gas—3448—W. Clark.
Hydrostatic rotatory motive power engines—3431—B. W. A. Sleigh.
Locks and latches—3420—A. J. Adams.
Metallic boxes—3428—F. Leonardt.
Metallic hoops—3374—A. Shanks.
Metals, cutting—3410—F. Watkins.
Metals, shaping—3412—F. Watkins.
Mortar, mixing—3450—L. G. Speyser.
Motive power—3363—J. Anderson.
Motive power—3373—J. Sloper.
Oakum—3435—C. Sheridan.
Oxygen and chlorine, producing—3171—J. T. A. Mallet.
Paper-making machinery—30—E. N. Gregory.
Phosphate of lime, treating—3359—C. Norrington.
Planing machines—2—W. Muir.
Portable folding chairs—6—H. A. James.
Printing surfaces, &c., obtained by photography, producing—3393—R. H. Ashton.
Pulleys, &c.—3389—J. Rodgers.
Railway carriages, coupling—18—W. Chippindale.
Railways, actuating the points of—3413—W. Thomson.
Railways, electric signals for—3089—E. Funnell.
Railways—3434—W. Clark.
Railway wheels—3414—E. F. Göransson.
Refuse matters, treating—3401—W. Bradburn.
Saccharine liquors, boiling—22—W. Knaggs.
Ships' bottoms, coating—3355—A. V. Newton.
Soap—3432—G. Payne.
Steam boilers—3372—P. Heyns.
Steam boilers—3407—E. Storey.
Thermo-electric and magnetic apparatus—3351—J. Baker.
Traps—3345—D. A. Graham.
Valves—3405—W. Clark.
Valves—3424—C. Harrison.
Venetian blinds—3379—S. and J. Mitchell.
War ships, &c.—3357—C. Lungley.
Water tuyeres—3375—F. Northall and R. Turnley.
Window blinds, &c., raising—3366—G. Allix.
Yarns, sizing—3397—J. Fletcher and W. Carr.
Yarn, winding—3362—R. and S. S. Hall.

Inventions with Complete Specifications Filed.

Hat bodies, felting—97—G. Haseltine.
Sewing machines—103—H. A. Bonneville.
Small arms—102—H. A. Bonneville.

Patents Sealed.

1882. S. Longbottom & T. Shaw.	1916. J. H. Johnson.
1884. F. Neidlinger.	1927. H. Prince.
1885. R. Irvine and P. Brash.	1930. J. and J. Hinks.
1891. H. Smith.	2012. W. Hartcliffe, jun., and T. H. Lee.
1895. W. Bellamy.	2026. W. E. Newton.
1906. E. Leigh, H. T. Palmer, and W. E. Whitehead.	2119. W. Clark.
1908. A. Kimball.	2123. W. E. Newton.
1915. G. Mountford and G. L. Loversidge.	2491. W. Clark.
	2653. E. M. Boxer.

From Commissioners of Patents' Journal, January 22nd.

Patents Sealed.

1918. W. B. Woodbury.	2298. J. Schneider.
1928. J. Strang.	2764. J. Fisher.
1929. J. Boeddinghaus.	2806. A. V. Newton.
1935. J. Vavasseur.	2900. G. Haseltine.
1948. W. Weldon.	3009. A. V. Newton.
1950. A. V. Mathieu.	3050. J. Howard & E. T. Bousfield.
1965. T. and J. Bibby.	3065. G. Haseltine.
2055. J. Clay.	

Patents on which the Stamp Duty of £50 has been Paid.

64. J. Coppard.	199. J. E. Dix.
111. W. Tongue.	222. W. Norton.
127. E. Lord.	148. J. D. Johin.
134. W. H. Marks.	151. J. Hamer.
211. T. Bradford.	156. J. Wilson.
245. S. Dixon and J. Calvert, jun.	158. G. E. Donisthorpe.
194. T. Bright.	165. J. Burch and S. Fearnley.
195. R. A. and E. Wright.	216. J. Stuttaford.

Patents on which the Stamp Duty of £100 has been Paid.

147. G. H. and H. R. Cottam.	155. J. F. Belleville.

Registered Designs.

Handles for Bottles—January 7—4832—G. Ireland, Birchfield, near Birmingham.
Boxing Gloves—January 19—4833—Snoxell and Spencer, 35, Old-street, St. Luke's, E.C.
Moustache Protector—January 22—4834—A. Arculus, Birmingham.
Improved Elastic Band Holder—January 23—4835—G. Twigg, Mosley-street, Birmingham.